

# Supplementary Material

Combining Image Compression with Digital Image Correlation

J. Yang and K. Bhattacharya

April 2, 2018

## **1 Demonstrations using Sample 14 L1, L3 and L5 Datasets**

Table 1: Absolute RMS errors of Sample 14 L1,L3 and L5 results using three DIC algorithms applied to the original images and the compressed images

Index	Image No.	Image compression	Local Subset DIC	Global DIC	AL-DIC
$\eta_1$ (pixels)	L1	Original	0.0212	0.0080	0.0139
		Wavelets 10 %	0.0318	0.0108	0.0211
		Wavelets 5 %	0.0515	0.0159	0.0351
		DCT 10 %	0.0406	0.0127	0.0274
		DCT 5 %	0.0671	0.0244	0.0652
	L3	Original	0.0202	0.0162	0.0136
		Wavelets 10 %	0.0316	0.0243	0.0216
		Wavelets 5 %	0.0523	0.0382	0.0356
		DCT 10 %	0.0404	0.0318	0.0277
		DCT 5 %	0.0675	0.0546	0.0488
	L5	Original	0.0201	0.0234	0.0141
		Wavelets 10 %	0.0322	0.0342	0.0228
		Wavelets 5 %	0.0517	0.0519	0.0364
		DCT 10 %	0.0405	0.0438	0.0284
		DCT 5 %	0.0669	0.0725	0.0491
$\xi_1$	L1	Original	–	$1.62 \times 10^{-4}$	$3.95 \times 10^{-4}$
		Wavelets 10 %	–	$4.36 \times 10^{-4}$	$8.82 \times 10^{-4}$
		Wavelets 5 %	–	$6.45 \times 10^{-4}$	0.0014
		DCT 10 %	–	$5.55 \times 10^{-4}$	0.0011
		DCT 5 %	–	$9.28 \times 10^{-4}$	0.0019
	L3	Original	–	$4.55 \times 10^{-4}$	$3.60 \times 10^{-4}$
		Wavelets 10 %	–	0.0027	$9.13 \times 10^{-4}$
		Wavelets 5 %	–	0.0042	0.0015
		DCT 10 %	–	0.0036	0.0011
		DCT 5 %	–	0.0060	0.0020
	L5	Original	–	0.0010	$8.20 \times 10^{-4}$
		Wavelets 10 %	–	0.0045	0.0013
		Wavelets 5 %	–	0.0068	0.0020
		DCT 10 %	–	0.0059	0.0016
		DCT 5 %	–	0.0097	0.0026

Table 2: Relative RMS errors of Sample 14 L1,L3 and L5 results using three DIC algorithms applied to the compressed images compared with results using the original images

Index	Image No.	Image compression	Local Subset DIC	Global DIC	AL-DIC
$\eta_2$ (pixels)	L1	Wavelets 10 %	0.0273	0.0079	0.0184
		Wavelets 5 %	0.0498	0.0143	0.0342
		DCT 10 %	0.0368	0.0100	0.0249
		DCT 5 %	0.0675	0.0243	0.0487
	L3	Wavelets 10 %	0.0273	0.0205	0.0185
		Wavelets 5 %	0.0506	0.0361	0.0344
		DCT 10 %	0.0371	0.0294	0.0253
		DCT 5 %	0.0677	0.0538	0.0490
	L5	Wavelets 10 %	0.0274	0.0286	0.0187
		Wavelets 5 %	0.0496	0.0490	0.0338
		DCT 10 %	0.0370	0.0412	0.0252
		DCT 5 %	0.0671	0.0719	0.0482
$\xi_2$	L1	Wavelets 10 %	—	$2.50 \times 10^{-4}$	$5.31 \times 10^{-4}$
		Wavelets 5 %	—	$4.27 \times 10^{-4}$	$9.78 \times 10^{-4}$
		DCT 10 %	—	$3.43 \times 10^{-4}$	$7.11 \times 10^{-4}$
		DCT 5 %	—	$6.39 \times 10^{-4}$	0.0013
	L3	Wavelets 10 %	—	0.0017	$5.39 \times 10^{-4}$
		Wavelets 5 %	—	0.0028	$9.79 \times 10^{-4}$
		DCT 10 %	—	0.0024	$7.23 \times 10^{-4}$
		DCT 5 %	—	0.0042	0.0013
	L5	Wavelets 10 %	—	0.0028	$7.00 \times 10^{-4}$
		Wavelets 5 %	—	0.0047	0.0012
		DCT 10 %	—	0.0040	$9.30 \times 10^{-4}$
		DCT 5 %	—	0.0068	0.0017

Table 3: Computation time of numerical demonstrations

DIC Image	Mesh	Image compression	Local Subset DIC(s)	Global DIC(s)	AL-DIC(s)
Sample 14 L1	$5 \times 5$	Original %	743.36	11026	3065.02
		Wavelets 10 %	577.87	11017	2456.17
		Wavelets 5 %	584.13	10620	2481.97
		DCT 10 %	633.68	11130	2701.39
		DCT 5 %	680.06	11130	2912.34
Sample 14 L3	$5 \times 5$	Original %	743.36	11368	2923.05
		Wavelets 10 %	570.79	10561	2402.54
		Wavelets 5 %	585.71	10949	2491.09
		DCT 10 %	645.59	11451	2743.24
		DCT 5 %	681.18	11451	2921.35
Sample 14 L5	$5 \times 5$	Original %	743.36	11967	2960.71
		Wavelets 10 %	568.34	11077	2397.14
		Wavelets 5 %	592.08	11232	2509.35
		DCT 10 %	637.72	12041	2742.74
		DCT 5 %	686.49	12041	2956.62

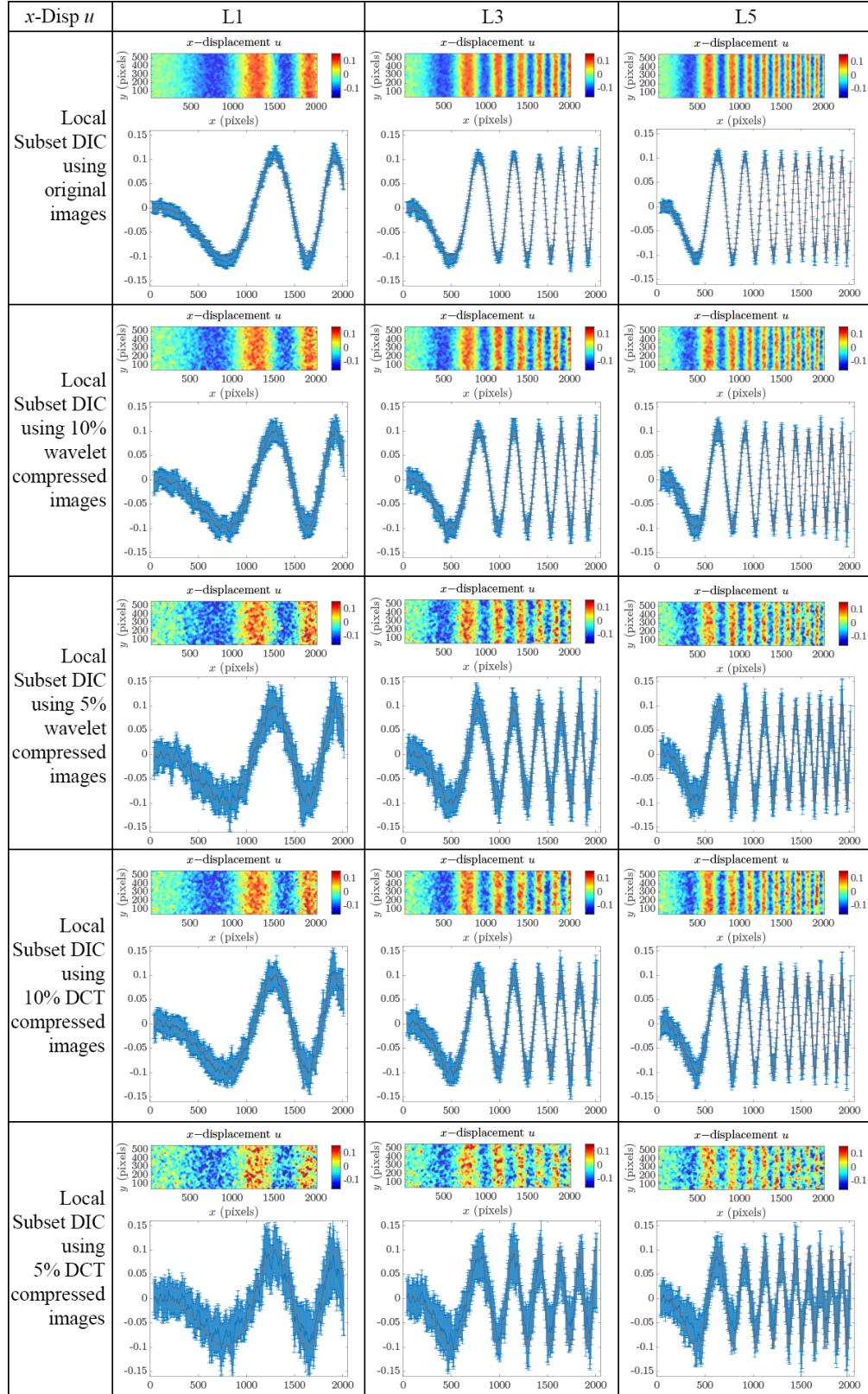


Figure 1: Displacement obtained using local subset DIC for Sample 14 L1, L3 and L5 cases using original, wavelet and DCT compressed images whose compression ratios are 10 % and 5 %.



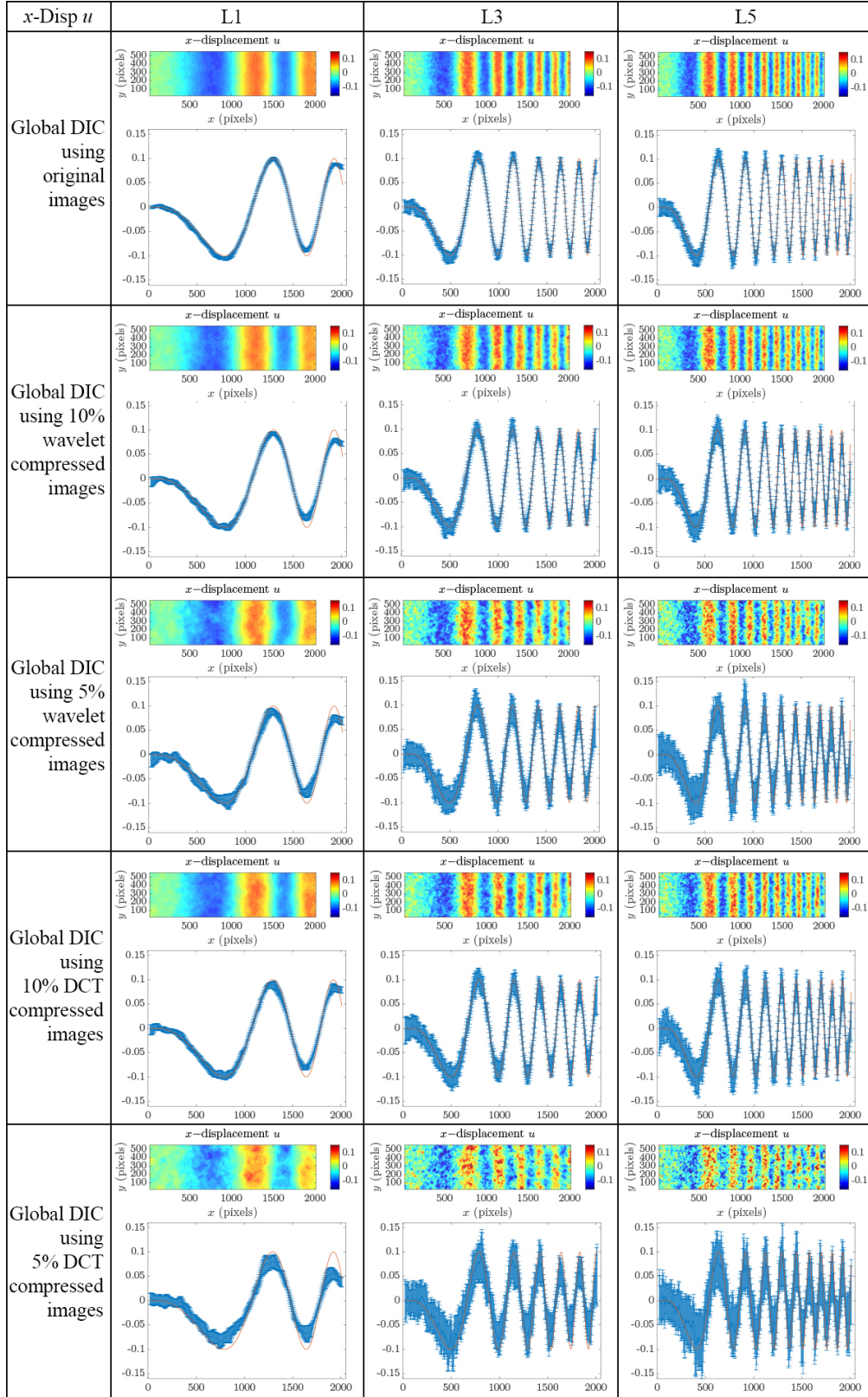


Figure 2: Displacement obtained using global DIC for Sample 14 L1, L3 and L5 cases using original, wavelet and DCT compressed images whose compression ratios are 10 % and 5 %.

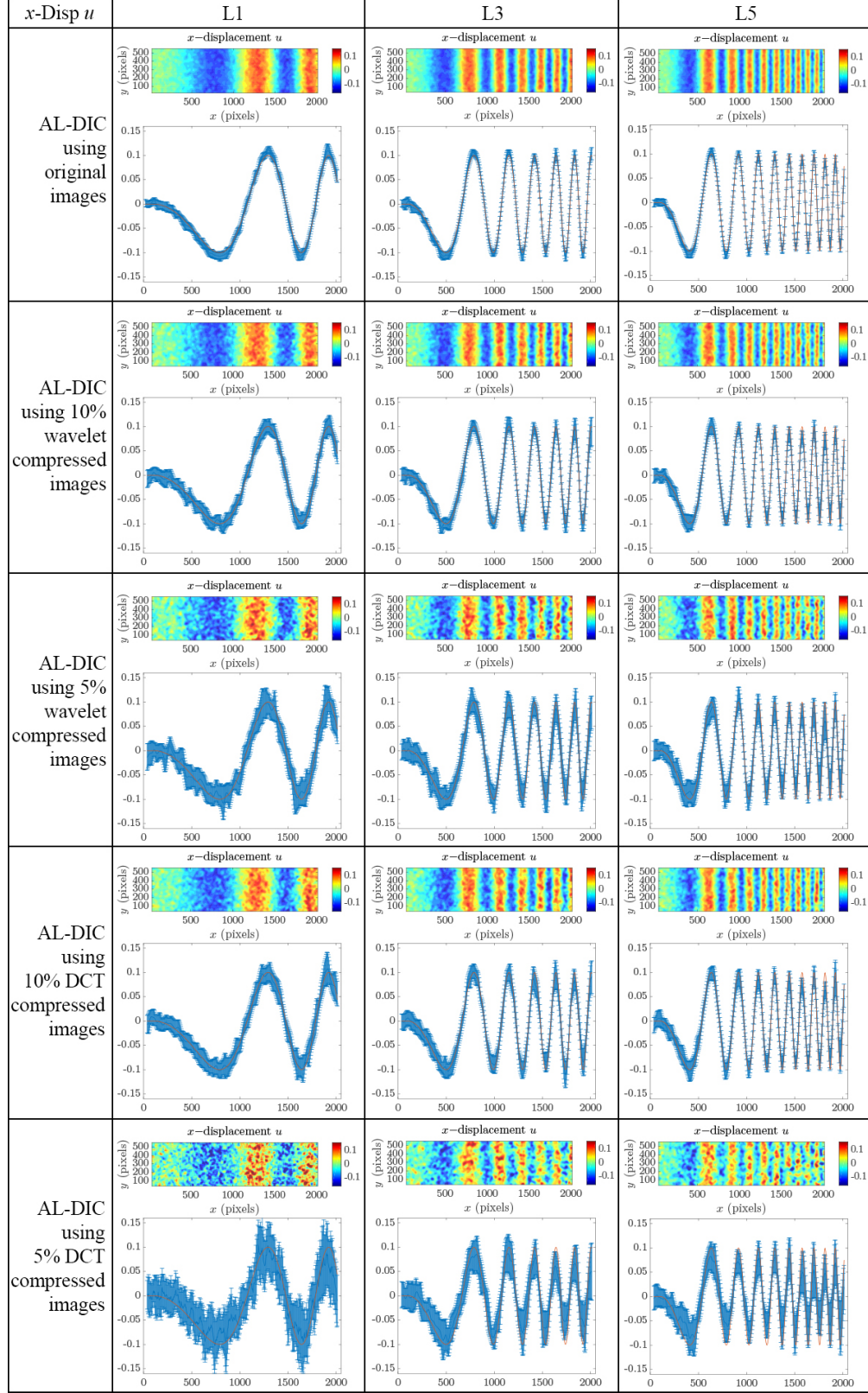


Figure 3: Displacement obtained using ALDIC for Sample 14 L1, L3 and L5 case using original, wavelet and DCT compressed images whose compression ratios are 10 % and 5 %.



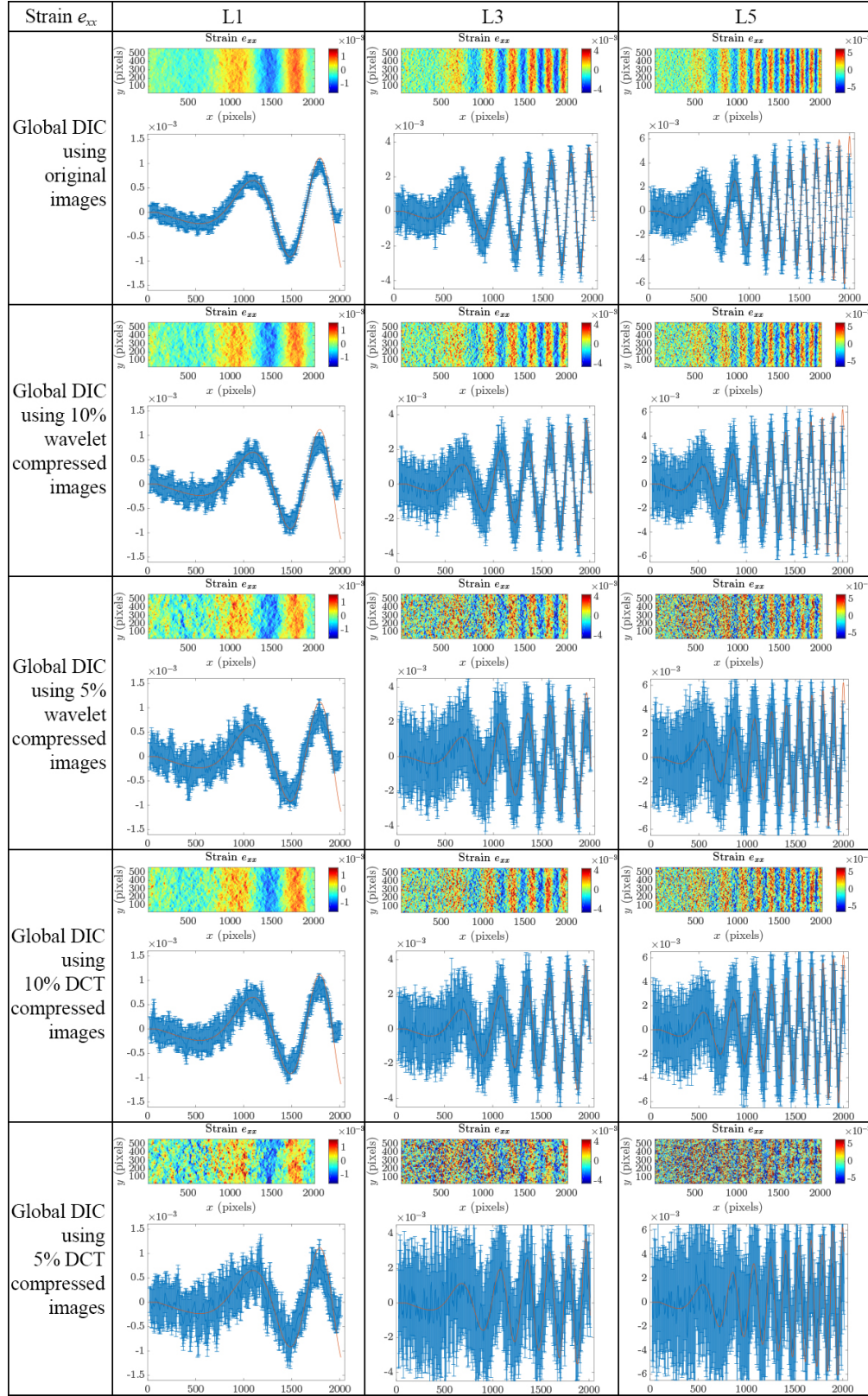


Figure 4: Strains obtained using global DIC for Sample 14 L1, L3 and L5 cases using original, wavelet and DCT compressed images whose compression ratios are 10 % and 5 %.

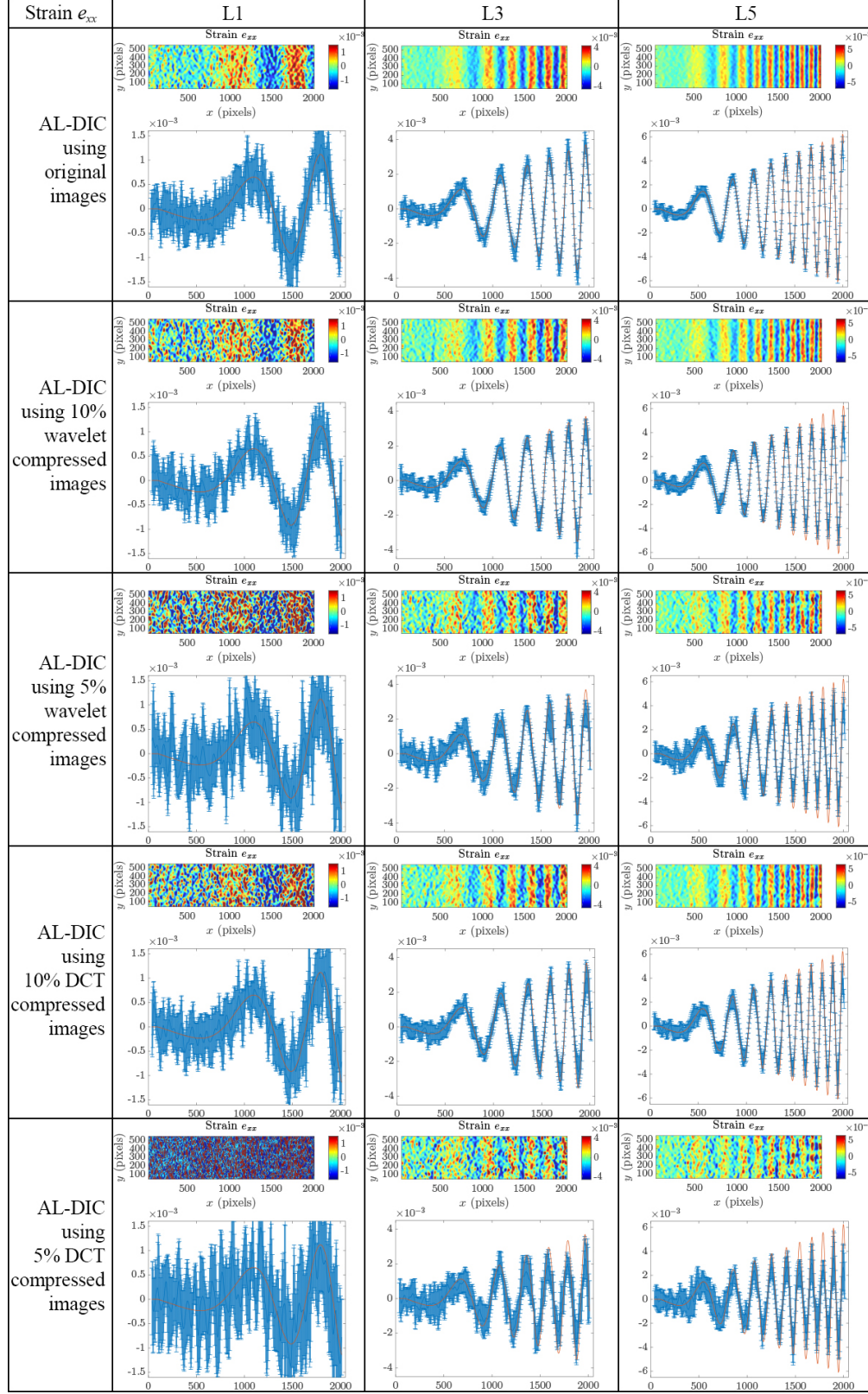


Figure 5: Strains obtained using ALDIC for Sample 14 L1, L3 and L5 cases using original, wavelet and DCT compressed images whose compression ratios are 10 % and 5 %.